

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 7,145,633 B2  
APPLICATION NO. : 10/538980  
DATED : December 5, 2006  
INVENTOR(S) : Nishimoto et al.

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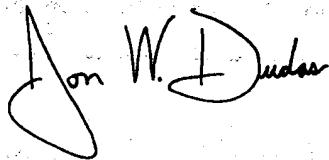
It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Delete Title page illustrating a figure, and substitute therefor, new Title page illustrating a figure. (attached)

Delete drawing sheets 1-6, and substitute therefor drawing sheets 1-6. (attached)

Signed and Sealed this

Third Day of April, 2007



JON W. DUDAS  
Director of the United States Patent and Trademark Office

(12) United States Patent  
Nishimoto et al.(10) Patent No.: US 7,145,633 B2  
(45) Date of Patent: Dec. 5, 2006

## (54) APPARATUS AND METHOD OF EXPOSING LIGHT TO A SEMICONDUCTOR DEVICE HAVING A CURVED SURFACE

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(73) Assignee: Yamatake Corporation, Tokyo (JP)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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§ 371 (c)(1),  
(2), (4) Date: Jun. 14, 2005

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PCT Pub. Date: Jul. 29, 2004

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G03B 27/48 (2006.01)

G03B 27/32 (2006.01)

G03F 1/00 (2006.01)

G03C 5/00 (2006.01)

G06F 19/00 (2006.01)

(52) U.S. Cl. .... 355/47; 355/48; 355/72;

355/77; 430/5; 430/311; 700/121

(58) Field of Classification Search .... 355/47,

355/48, 49, 53, 72, 77; 430/5, 311; 700/121

See application file for complete search history.

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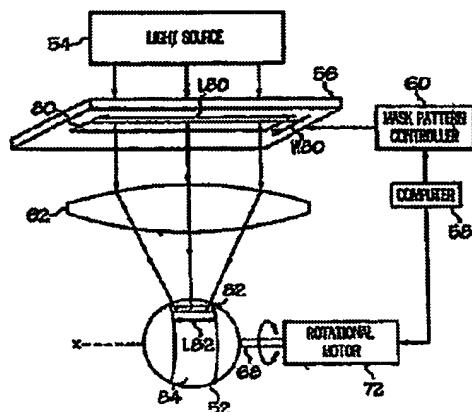
Primary Examiner—Alan Mathews

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## (57) ABSTRACT

A semiconductor manufacturing station (50) exposes light on a surface area of a spherical semiconductor device or ball (52). A mask pattern generator (56) provides a pattern of light, which undergoes temporal changes to collectively represent an image. The mask pattern generator has an active exposure contour (60) that provides a portion of the overall image. The pattern of light is directed through a lens (62) to the surface area of the semiconductor device. The semiconductor device rotates in relation to the temporal changes in the pattern of light to expose the pattern of light over a portion of a surface area of the semiconductor device. The exposure contour has a narrower center and becomes wider moving away from the center. The exposure contour may have a curvature.

22 Claims, 6 Drawing Sheets



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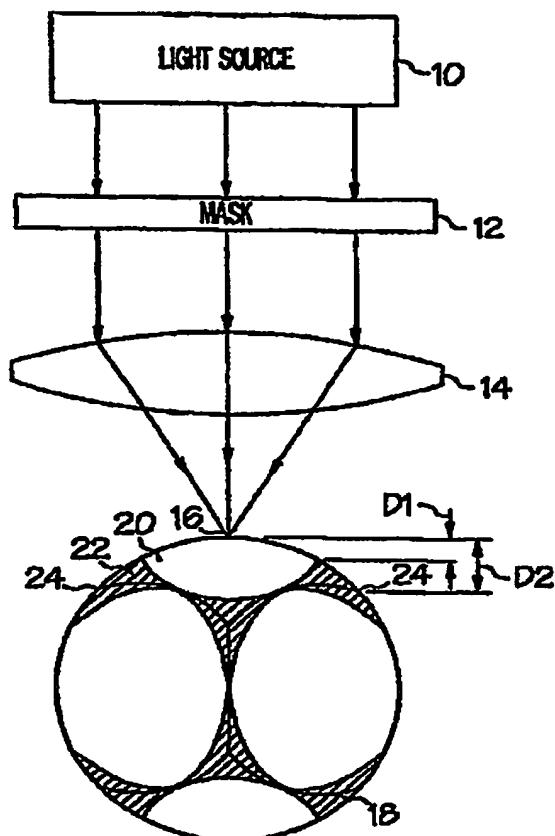


FIG. 1  
(PRIOR ART)

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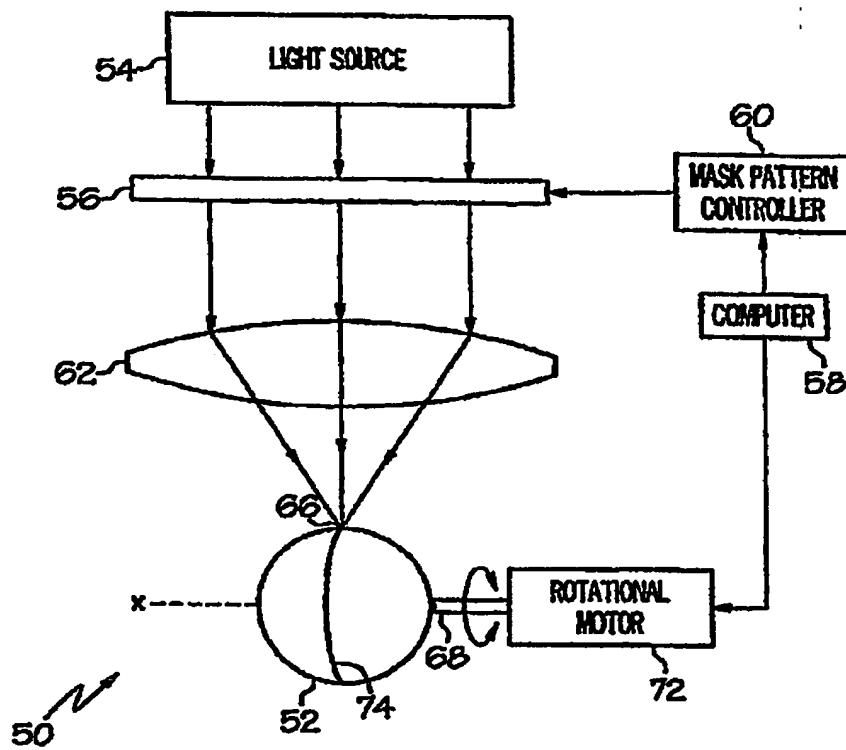


FIG. 2

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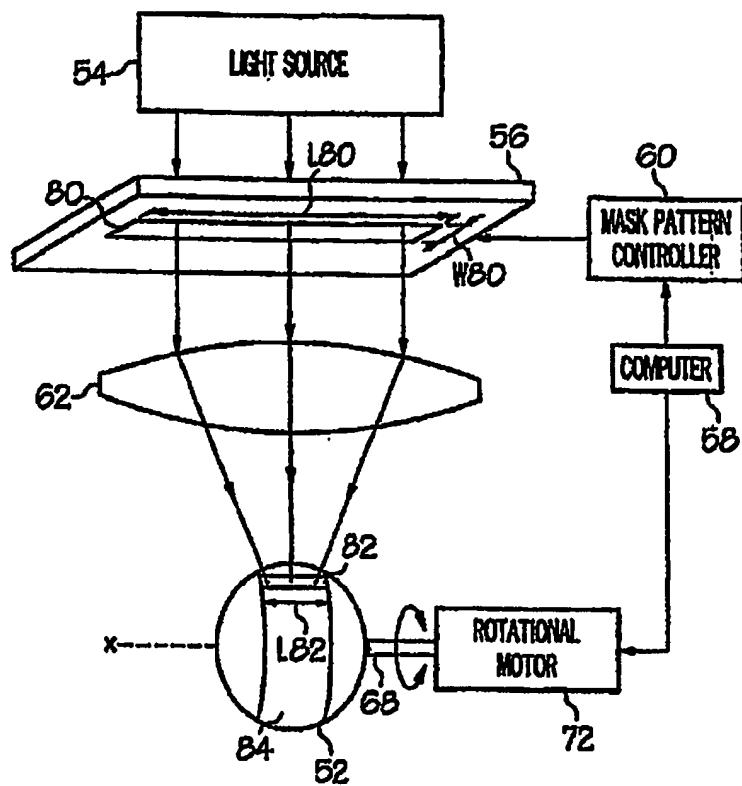


FIG. 3

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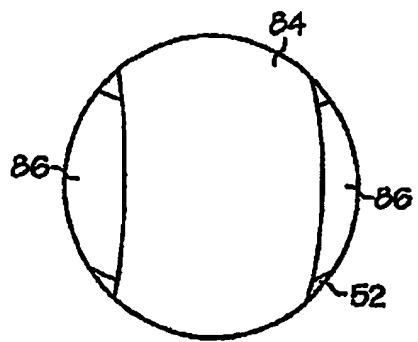


FIG. 4a

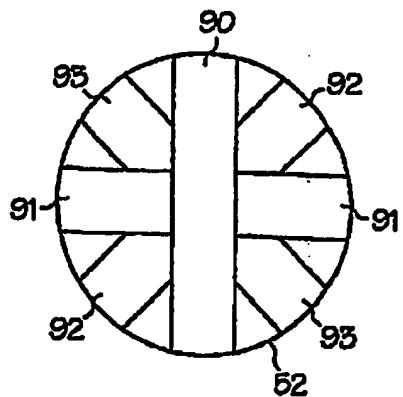


FIG. 4b

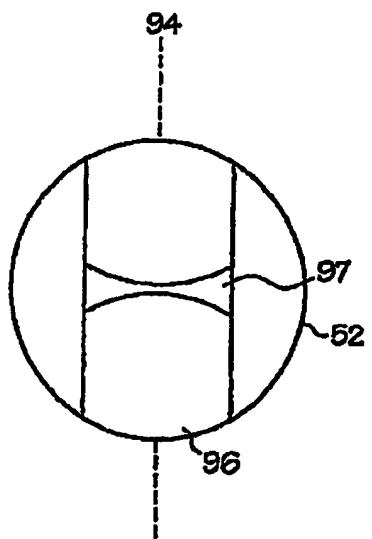


FIG. 5a

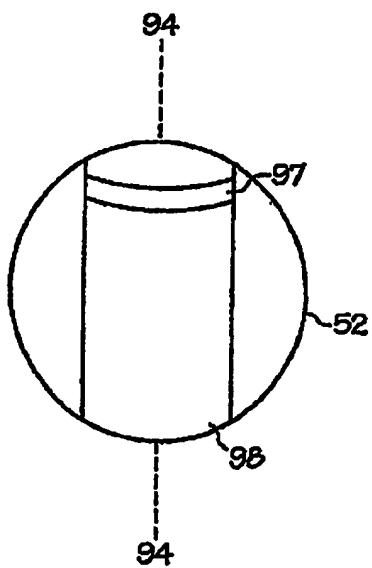


FIG. 5b

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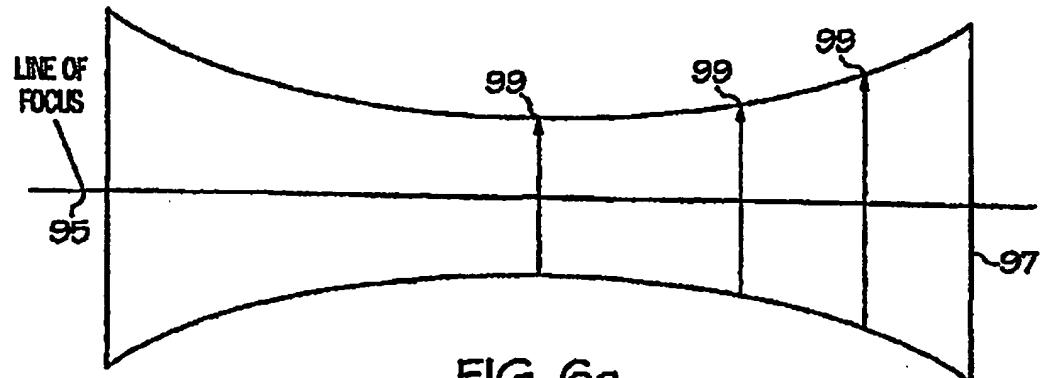


FIG. 6a

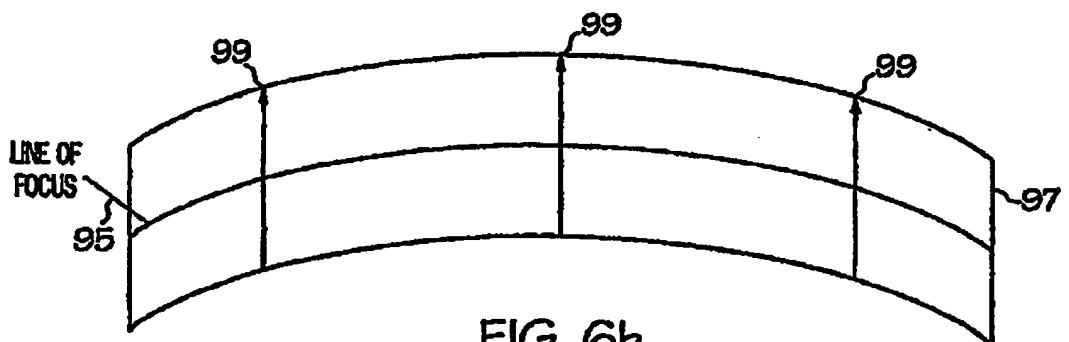


FIG. 6b

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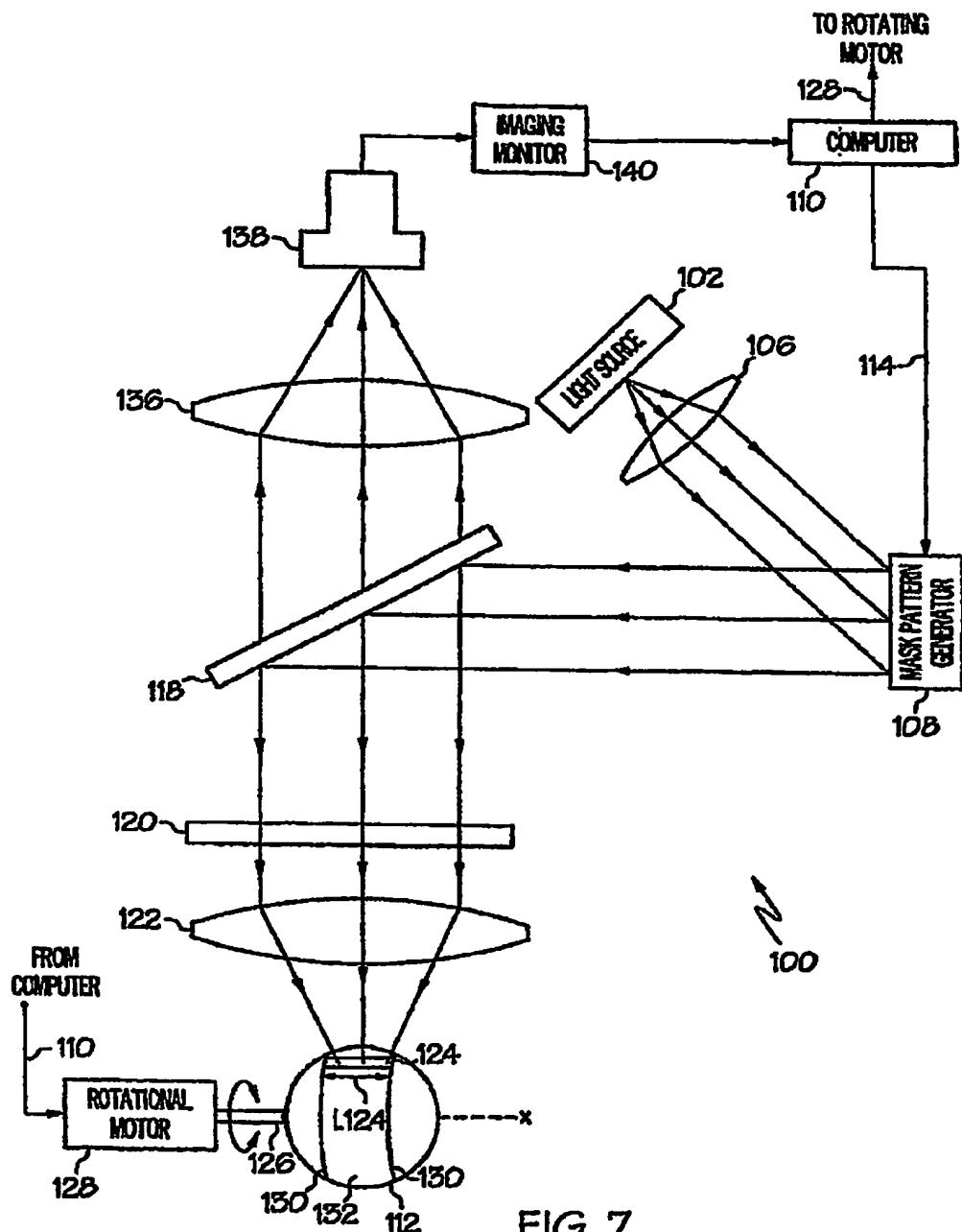


FIG. 7